(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 828 610 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
26.04.2000 Bulletin 2000/17

(21) Application number: **96915223.0**

(22) Date of filing: **17.05.1996**

(51) Int Cl.[7]: **B41F 15/44**

(86) International application number:
PCT/NL96/00203

(87) International publication number:
WO 96/37367 (28.11.1996 Gazette 1996/52)

(54) SQUEEGEE MADE OF FIBRE-REINFORCED PLASTIC

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RACLE CONSTITUE DE PLASTIQUE RENFORCE PAR DES FIBRES

(84) Designated Contracting States:
AT DE ES FR GB IT NL

(30) Priority: **24.05.1995 NL 1000437**

(43) Date of publication of application:
18.03.1998 Bulletin 1998/12

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EP-A- 0 454 404
EP-A- 0 743 181
DE-U- 9 113 542
FR-A- 2 707 918
US-A- 4 549 933

EP 0 828 610 B1

Description

[0001] The invention relates to screen printing devices, in particular rotary screen printing devices, provided with a squeegee.

[0002] Squeegee systems provide for the supply and distribution of printing paste within stencils of rotary screen printing devices. The printing paste is applied to the substrate to be printed through the apertures of the stencil using a squeegee blade.

[0003] The squeegee systems used hitherto are assembled from plates and tubes of stainless-steel or aluminium. The separate components, and also the assembly thereof, have to satisfy a number of physical and chemical requirements. One of these relates to the (flexural) stiffness. The squeegee has to retain its shape under the loading occurring during use as a consequence of the squeegee force, frictional force and the inherent weight of the squeegee. Considerable bending of the fitted squeegee has to be avoided with a view to printing quality, in particular to paste yield.

[0004] An important factor in this connection is the weight of the squeegee. Firstly, as little bending as possible of the squeegee under the inherent weight thereof is desirable in order to achieve a uniform contact of the squeegee blade of the squeegee system with the stencil of the screen printing device. Such a uniform contact gives a uniform printing quality. Secondly, the weight of the squeegee is of importance to the operating staff of the printing device. When the colour and/or pattern of the printed matter is changed, the squeegee also has to be replaced. The handling of a squeegee is, however, difficult as a consequence of the weight, relative to the length thereof, which may be more than 3 metres, and the small diameter of the stencil in which the squeegee has to be received. When heavy squeegees are replaced, the risk of damage to the squeegee and/or the stencil is therefore not inconsiderable.

[0005] As has been indicated briefly above, a high flexural stiffness of the squeegee is desirable in order to limit bending under the inherent weight thereof. This also applies to bending under the influence of the other forces acting on the squeegee during operation.

[0006] In the past there have been various attempts to simplify the replacement of squeegees and/or stencils in rotary screen printing units, as is illustrated herinafter in the following brief discussion of such attempts.

[0007] EP-A-0 612 615 discloses a device for suspending a squeegee in a cylindrical screen of a rotary screen printing apparatus, wherein one of the squeegee supports is provided with a guide element for guiding one end of the squeegee into an accommodation opening during mounting of the squeegee in the cylindrical screen, thereby enabling the mounting by one person.

[0008] EP-A-0 533 053 discloses a stencil mounting for rotary screen printing devices, wherein the mounting of a stencil is simplified by a specially configured receiving ring of the stencil mounting, as a result of which the operator has one hand free and/or allowing automation of the mounting.

[0009] Furthermore a device for changing a squeegee is known from EP-A-0 463 699, comprising a horizontal guide placed on a stand and a carriage, which is displaceable along the guide and upon which means for gripping the end part of a squeegee are fixed, thereby reducing the loading imposed on the back and arms of the operator during the replacement of the squeegee.

[0010] Another system known in the art comprises a small roller, which supports the squeegee during replacement, as a result of which the operator has to carry a less heavy weight.

[0011] Still another rotary screen printing system is known in the art, wherein the configuration thereof allows for the vertical displacement of the assembly of screen and squeegee in order to change colours, screens etc.. (See e.g. a brochure "Kompromißlos in Qualität und Leistung" of Maschinenbau Kiefersgelden GmbH, relating to MBK textile machines).

[0012] In another brochure of Johannes Zimmer "Innovations-Informations", Paris (ITMA 1987), automation of a textile printing machine is discussed in view of automatic colour change.

[0013] The prior art discussed above indicates that in general the use of aids has been suggested in order to reduce the above identified problems and disadvantages. However, it has not been proposed to reduce the weight of the squeegee itself in order to reduce the load imposed on the operators during replacement of a squeegee, thereby minimising the health risk and allowing a quick replacement of squeegees in order to minimise the standstill period.

[0014] Furthermore EP-A-0 743 181, which is state of the art under Article 54(3) EPC, describes a device for the distribution of a fluid medium, like printing paste, e. g. in a screen printing device, wherein at least one tube is present, which is provided with passage openings for said medium, spaced apart over the tube length. According to this document the tube wall is composed of a reinforced plastic at least partially over its length, e.g. a carbon fibre-reinforced plastic.

[0015] The object of the present invention is to provide a squeegee for application in a screen printing device, which does not have the above mentioned disadvantages.

[0016] More specifically an object of the present invention is to provide such a squeegee, whose manipulability has been increased.

[0017] In addition, an object of the invention is to provide a squeegee whose flexural stiffness has been increased.

[0018] A further object of the invention is to provide a squeegee whose stiffness and weight ratio has been improved.

[0019] The screen printing device according to the invention is defined in claims 1 and 3 respectively. A squeegee for use in a screen printing device is defined

in claim 6. Such a squeegee satisfies the abovementioned objectives.

[0020] A squeegee composed at least partially of fibre-reinforced plastic can be manufactured with a lower weight than a conventional squeegee manufactured entirely from aluminium or stainless steel, as a result of which the manipulability is increased to a great extent. The weight saving can amount to approximately 70% for a constant flexural stiffness, depending on the configuration of the squeegee, the number of components manufactured from fibre-reinforced plastic in the squeegee and the nature of the fibre-reinforced plastic.

[0021] The flexural stiffness of a conventional squeegee can furthermore be increased by, for example, reinforcing its most heavily loaded components with the fibre-reinforced plastic.

[0022] Besides it is noted that devices, made from fibre-reinforced plastic, for application in papermaking machines are known per se, e.g. from US-A-4 549 933, DE- U1-91 13 542.7 and EP-A-0 454 404. However, these devices having a fibre-reinforced plastic scraper or doctor blade are used to remove paper and the like, for example from rolls. DE-U-9113542 discloses an object, a so-called "Schaber", for use in devices for manufacturing or processing of fibre based webs, like paper webs. This object comprises inter alia a supporting member, which is composed of a fibre-reinforced plastic, in which the fibres are orientated in the longitudinal direction of this member. The use of this object in screen printing devices is not mentioned. Furthermore a squeegee having a plastic squeegee blade for printing applications, in particular flexography is known from FR-A-2 707 918. None of these publications is directed to screen printing squeegees.

[0023] According to the invention a combination effect, i.e. a weight saving and an increase in the flexural stiffness, can be obtained by a suitable material choice for the plastic and the fibres.

[0024] The physical properties of plastic alone are in general insufficient to satisfy the strength requirements, in particular in relation to the flexural stiffness, to be imposed on a squeegee. The plastic therefore has to be reinforced with fibres. In this connection, the (volume) percentage of fibres and the orientation of the fibres are factors which influence the physical properties of the fibre-reinforced plastic. The ratio of the density and the modulus of elasticity of the fibre-reinforced plastic determines the weight saving to be achieved and the flexural stiffness to be achieved compared with a conventional squeegee having the same structure.

[0025] The squeegee may be composed in its entirety of a fibre-reinforced plastic, or one or more components of the squeegee, for example the supporting centre part and/or the paste distribution tube, may be manufactured from fibre-reinforced plastic, while the other components are composed of conventional materials. A laminated structure, for example a metal core with plastic wrapped thereon, is also included in the possibilities. The weight saving in the case of a squeegee manufactured in its entirety from fibre-reinforced plastic will be greater than in the case of a composite squeegee made of stainless steel and/or aluminium and fibre-reinforced plastic.

[0026] The plastic can be selected from known materials, for example polyester, vinyl ester and epoxy resins. The last two have a greater chemical resistance and are consequently preferable.

[0027] The fibre can also be selected from known materials, such as glass fibres, carbon fibres and aramid fibres. Carbon fibres are preferred from the point of view of the favourable ratio of the density and the modulus of elasticity with respect to that of the conventional materials. Glass fibres and aramid fibres are, however, more advantageous from the point of view of cost price than carbon fibres. Combinations of a plurality of fibres in the plastic or components made of plastic reinforced with different fibres can also be used. The orientation of the fibres is not particularly limited. Preferably the fibres are mainly orientated in the longitudinal direction of the squeegee in order to enhance the flexural stiffness thereof perpendicular to the longitudinal axis, thereby further reducing the bending of the squeegee.

[0028] In particular, a light-weight squeegee is of importance for broader types of screenprinting machines, that is to say for widths of 3 to 4 metres or more. A low squeegee weight is also of importance for the sheet-fed printing press (European Patent Application 93200783.4) because, in that case, the squeegee has to be lifted during every revolution of the stencil in order to allow the intermediate bar to pass. This operation has to be carried out quickly and a low squeegee weight is therefore desirable.

[0029] Depending on the application, the fibre-reinforced plastic also has to satisfy other standard requirements imposed on squeegees, such as wear resistance to the printing pastes, (impact/drop) loading during squeegee replacement and chemical resistance to conventionally used printing pastes, acids, bases and solvents.

[0030] The components of the squeegee can be manufactured with the aid of conventional techniques, such as pultrusion, from fibre-reinforced plastic and then assembled.

[0031] The invention will be explained below with reference to the following drawing, in which:

[0032] Figures 1 - 6 are diagrammatic sections of different embodiments of a squeegee according to the invention which have been manufactured at least partially from fibre-reinforced plastic.

[0033] Figure 1 shows diagrammatically a conventional configuration of a squeegee for use in a rotary screen printing system. The squeegee comprises a centre part 1 as support, which is provided at both ends with end parts (not shown), a distribution tube 2 for printing paste 3, an overflow groove 4 and a squeegee blade 5 which is mounted in a conventional manner in a squee-

gee blade holder 6. The squeegee is disposed in a stencil 7. The printing paste 3 is applied to a web 8 of material to be printed through the apertures in the stencil 7 with the aid of the squeegee blade 5.

[0034] Figure 2 shows another known squeegee configuration 21 made of a conventionally used material, which configuration is, however, stiffened with the aid of bars 22 made of fibre-reinforced plastic. Such an embodiment yields an appreciably smaller improvement in the weight and stiffness ratio.

[0035] Figures 3 - 5 show other embodiments in which various components of the squeegee are composed of fibre-reinforced plastic. In such embodiments, the correct material and the appropriate manufacturing method can be selected for each component, which results in a simpler and cheaper structure of the components. A squeegee assembled therefrom can also satisfy higher requirements as a result of optimization of the components. Further advantages of such embodiments, such as greater diversity in shape with a limited number of components, possible alterations for each component and lower costs for moulds, patterns and the like, are related to the modular structure.

[0036] Figure 3 shows such an embodiment 31 of a squeegee according to the invention whose centre profiled section 32 comprises a core of metal 33 with an encasement 34 wound thereon of fibre-reinforced plastic. At the point of attachment of the paste distribution tube 35, the metal core 33 is reinforced, in this example, with reinforcing ribs 36, 37 respectively. The metal of the core 33 can optionally be replaced by other materials such as plastic (foam).

[0037] In Figure 4, the centre part 42 of the squeegee 41 is composed of a commercially obtainable carbon-fibre-reinforced plastic hollow profiled section, while the separate distribution tube 43 is manufactured from another material.

[0038] Figure 5 shows a similar hollow profiled section 52 having a rectangular section of the squeegee 51, in which, however, provisions are provided for the attachment of the remaining squeegee components. Such profiled sections will have to be specially fabricated. In general, a cylindrical hollow profiled section (not shown) having such attachment means can be shaped in a simple manner.

[0039] In the case of the embodiments shown in Figures 3 - 5 and having modular structure, the end parts will conventionally be manufactured from metal because the attachment of the squeegee to the frame of the system and also the coupling to the paste supply lines can take place more advantageously as a result. The paste distribution systems can also be manufactured from the fibre-reinforced plastic, depending on the complexity of the duct system present therein. Replaceability of said systems in connection with various viscosities of other pastes and varying width of the material to be printed is also advantageous. Unduly large tolerances in the straightness of the supporting centre part can be obviated by a straight assembly of the squeegee-blade holder, a clamping mechanism, on the hollow profiled section, as shown in Figures 3 - 5.

[0040] An important advantage of the use of the above profiled sections is that the centre part of the squeegee can be sawn to length for any desired printing width, after which the replaceable end parts can be attached thereto.

[0041] Finally, Figure 6 shows a configuration 61 which is comparable to Figure 1 and is composed of an integral centre part 62 which also comprises the paste distribution tube 63. In this example, the entire squeegee, including the end parts, except the squeegee blade 5 is manufactured in one piece from a carbon-fibre-reinforced epoxy resin. For an approximately equal value of the flexural stiffness, the squeegee constructed in this way yields a weight saving of approximately 70% with respect to a squeegee manufactured from stainless steel.

Claims

1. Screen printing device provided with a squeegee, in particular a rotary screen printing device, wherein a part of the squeegee is composed at least partially of a fibre-reinforced plastic, provided that said part is not a wall of a tube, which tube provides a paste distribution channel and wherein the wall of the tube is provided with a plurality of passage openings, spaced apart over the tube length.

2. Device according to claim 1, wherein the fibres of the fibre-reinforced plastic are orientated in the longitudinal direction of the squeegee.

3. Screen printing device provided with a squeegee, in particular a rotary screen printing device, wherein the squeegee is composed at least partially of a fibre-reinforced plastic and wherein the fibres of the fibre-reinforced plastic are orientated in the longitudinal direction of the squeegee.

4. Device according to one of the preceding claims 1-3, wherein the fibre in the fibre-reinforced plastic is a carbon fibre.

5. Device according to one of the preceding claims 1-4 wherein the plastic is selected from polyester, vinyl ester and/or epoxy resins.

6. Screen printing squeegee for use in a screen printing device according to one of the preceding claims 1-5, the squeegee comprising paste distribution means (2, 35, 43, 63) for distributing printing paste, wherein a part of the squeegee is composed at least partially of a fibre-reinforced plastic, provided that said part is not a wall of a tube, which tube provides

a paste distribution channel and wherein the wall of the tube is provided with a plurality of passage openings, spaced apart over the tube length.

Patentansprüche

1. Siebdruckvorrichtung mit einer Rakel, insbesondere Rotations-Siebdruckvorrichtung, in der ein Teil der Rakel zumindest teilweise aus einem faserverstärkten Kunststoff besteht, vorausgesetzt daß dieses Teil nicht die Wand eines Rohrs ist, das einen Pastenverteilungskanal bildet, dessen Wand mit einer Mehrzahl von über die Rohrlänge verteilt angeordneten Durchlaßöffnungen versehen ist.

2. Vorrichtung nach Anspruch 1, in der die Fasern des faserverstärkten Kunststoffes in Längsrichtung der Rakel ausgerichtet sind.

3. Siebdruckvorrichtung mit einer Rakel, insbesondere Rotations-Siebdruckvorrichtung, in der die Rakel zumindest teilweise aus einem faserverstärkten Kunststoff besteht und die Fasern des faserverstärkten Kunststoffes in Längsrichtung der Rakel ausgerichtet sind.

4. Vorrichtung nach einem der vorstehenden Ansprüche 1 bis 3, in der die Faser in dem faserverstärkten Kunststoff eine Carbonfaser ist.

5. Vorrichtung nach einem der vorstehenden Ansprüche 1 bis 4, in der der Kunststoff aus Polyester-, Vinylester- und/oder Epoxyharz ausgewählt ist.

6. Siebdruck-Rakel zur Verwendung in einer Siebdruckvorrichtung gemäß einem der vorstehenden Ansprüche 1 bis 5, in der die Rakel Pastenverteilmittel (2, 35, 43, 63) zur Verteilung der Druckpaste aufweist, wobei ein Teil der Rakel zumindest teilweise aus einem faserverstärkten Kunststoff besteht, vorausgesetzt daß dieses Teil nicht die Wand eines Rohrs ist, das einen Pastenverteilungskanal bildet, dessen Wand mit einer Mehrzahl von über die Rohrlänge verteilt angeordneten Durchlaßöffnungen versehen ist.

Revendications

1. Installation d'impression par sérigraphie munie d'une racle, en particulier une installation d'impression au moyen d'écran rotatif, dans laquelle une partie de la racle est composée au moins partiellement de matière plastique renforcée de fibres, ladite partie ne devant pas constituer la paroi d'un tube alimentant un canal de distribution de la pâte, ladite paroi du tube étant pourvue d'une pluralité de trous de passage espacés le long du tube.

2. Installation selon la revendication 1, dans laquelle les fibres de renforcement du plastique sont orientées en direction longitudinale de la racle.

3. Installation d'impression par sérigraphie munie d'une racle, en particulier installation d'impression au moyen d'un écran rotatif, dans laquelle la racle est composée au moins partiellement d'un plastique renforcé de fibres lesquelles sont orientées en direction longitudinale de la racle.

4. Installation selon l'une des revendications 1 à 3, dans laquelle la fibre du plastique renforcé est une fibre de carbone.

5. Installation selon l'une des revendications 1 à 4, dans laquelle la matière plastique est choisie dans le groupe comprenant le polyester, vinylester et/ou résine époxy.

6. Racle pour impression par sérigraphie pour application dans une installation selon l'une des revendications 1 à 5, comprenant des moyens pour la distribution de la pâte (2,35,43,63); dans laquelle une partie de la racle est composée au moins partiellement de plastique renforcé de fibres, ladite partie ne devant pas constituer la paroi du tube alimentant le canal de distribution de la pâte, ladite paroi du tube étant pourvue d'une plularité de trous de passage espacés le long du tube.

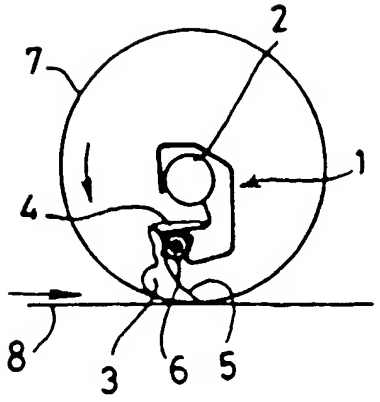

Fig.1.

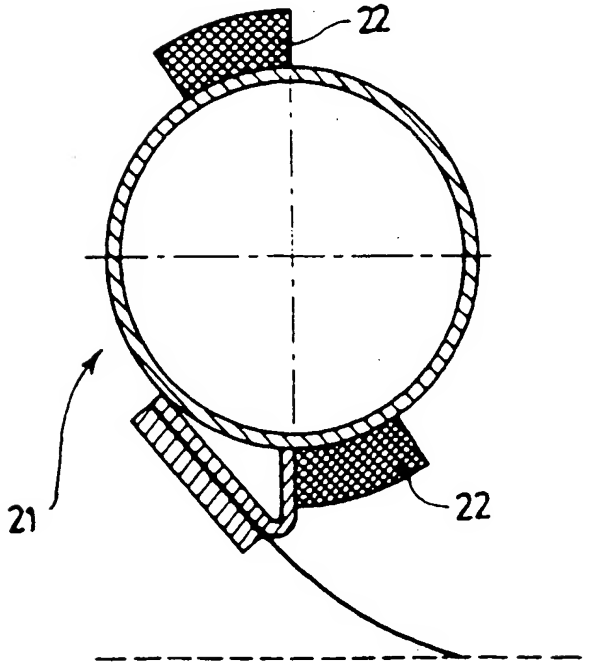

Fig.2.

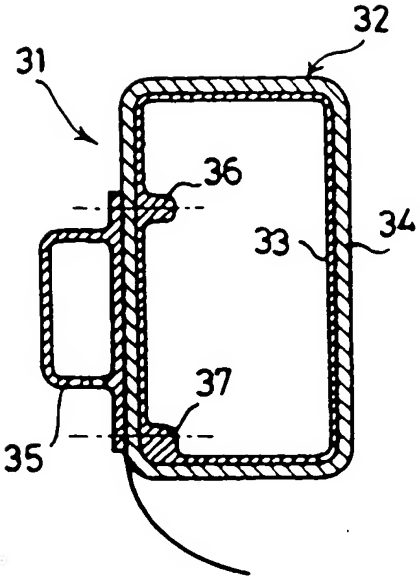

Fig: 3.

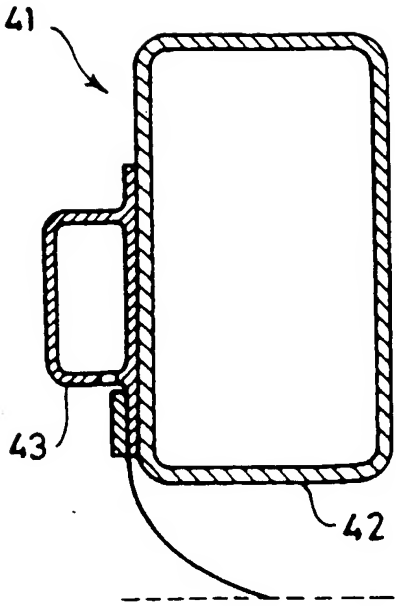

Fig: 4.

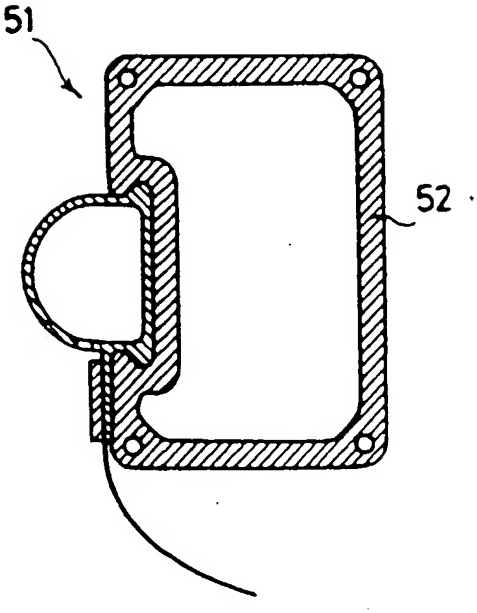

Fig: 5.

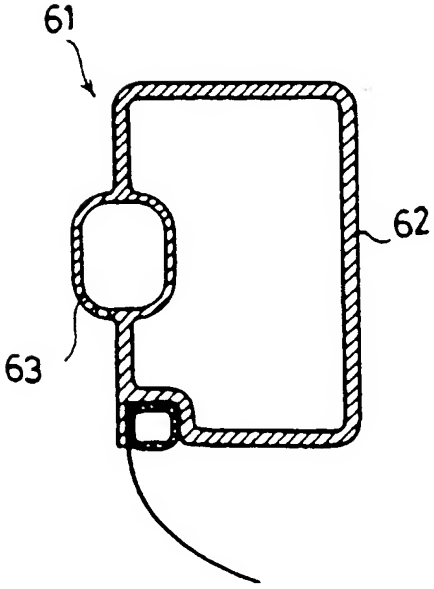

Fig: 6.